REMARKS

Claims 1-20 are pending in the application and have been examined. The present office action is addressed as follows.

Claims 1-6, 14, 16, and 17 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Schilling et al. (U.S. Patent No. 3,952,939). Applicants traverse the rejection.

The examiner asserts that claim 1 does not recite bonding semiconductor wafers. The term "wafer" has been used consistently throughout the Specification to indicate semiconductor wafers. That meaning has also been discussed during prosecution. In response to the examiner's statement, applicants have amended the claims to explicitly recite that semiconductor wafers are provided.

The examiner also states that the structural limitation of a wafer does not "manipulatively distinguish" the claim, and thus has no patentable weight. However, the materials on which a process is carried out must be accorded weight in determining the patentability of a process (See MPEP § 2116; *Ex parte Leonard*, 187 USPQ 122 (Bd. App. 1974)). In the present application, the process recited in the claims is carried out on semiconductor wafers, as is clearly recited in the claims and taught in the specification. Also, the semiconductor wafers are required to form the necessary weak bond in the step of bringing. Accordingly, the fact that the claimed bonding method is carried out on semiconductor wafers must be given patentable weight.

Schilling is directed to a sheet cladding method, and discloses metallurgically bonding a protective sheet cladding to a convex-concave substrate. That is, Schilling requires that both the cladding and the substrate be formed from a metal. For example, Schilling discloses that a convex-concave substrate is given a nickel plate prior to bonding (See Schilling, col. 4, lns. 16-19). Similarly, the cladding to be bonded to the substrate was a Ni-50Cr alloy (See col. 4, lns. 24-24-25). In contrast, the process recited in claim 1 requires providing semiconductor wafers to be bonded. Thus, for at least the above reasons, applicants request withdrawal of the rejection.

Also, Schilling lacks a step of bringing as recited in claim 1. This step results in a necessary weak bond between the semiconductor wafers (See applicants' Specification, p. 11, lns. 10-15). No such bond is formed in Schilling. Schilling's bonding process merely includes a step of pre-forming a cladding blank to fit closely around a substrate and masking all seams in the cladding to prevent penetration by a pressure transmitting medium. The cladding and substrate are then sealed into a deformable container, along with the pressure transmitting medium, and diffusion bonding takes place (See Schilling, col. 3, lns. 8-10; col. 3, lns. 48-51; col. 3, lns. 55-64). Thus, the bonding process taught in Schilling fails to disclose bringing the substrate and cladding together to weakly bond them together, as recited in claim 1. For this additional reason, applicants again request withdrawal of the rejection.

Claims 1-20 Stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bhat et al. (U.S. Patent No. 5,207,864) in view of Cohn et al. (U.S. Patent No.

7,276,789), and further in view of Applicants' Admitted Prior Art (hereinafter, "AAPA"). Applicants traverse this rejection because it would not have been obvious to one of ordinary skill in the art to combine the cited prior art references, and because the relevant art cited fails to disclose or suggest the application of isostatic pressure to the wafers.

Bhat discloses that, together with pressure, a temperature of 650°C may be applied to a pair of wafers to join them (See Bhat, col. 3, lns. 48-50). However, as acknowledged by the examiner, Bhat fails to disclose that isostatic pressure is applied to the wafers. Instead, Bhat teaches that a molybdenum weight is placed on top of the pair of wafers to assure close contact (See col. 3, lns. 43-45). Not recognized in the rejection is an important additional difference. The present invention as recited in claims 1 and 19 first establishes a weak bond between wafers in the step of bringing (See applicants' Specification, p. 11, lns. 8-15). The Specification recognizes that a subsequent step of isostatic pressing could be performed. Bhat assumes that an isostatic pressing step would not work. Bhat presumes, apparently, that the weight is necessary because a subsequent step of isostatic pressing would break the weak bond formed between the wafers. This is the general assumption in the art (see applicants' Specification p. 5, ln. 26 – p. 6, ln. 5; p. 10, lns. 1-5).

The examiner relies on Cohn to disclose that hot isostatic pressing was used to bond materials. Cohn teaches that a potential method of supplying necessary pressure and heat to thermocompressively bond two substrates is to place the substrates into a polyimide or metal foil bag and subject the bag to hot isostatic pressing (See Cohn col.

10, lns. 9-12). In contrast, the present Specification teaches that the weak bonding that occurs during the step of bringing obviates the need to place the wafers into a sealed container (See applicants' Specification, p. 5, lns. 26-30). Moreover, Cohn contemplates the use of weights or billets 292, 292' for pressing used to deliver compressive force to wafers (see Cohn, col 9, lns. 60-67). Thus Cohn, like Bhat, seems to presume that weights are necessary to the bonding process.

Also, Cohn teaches only that a single bonding step of applying thermocompressive force is required. That is, Cohn is silent regarding a multi-step bonding process, where substrates are first brought together to weakly bond the substrates to one another. Cohn teaches that only a single thermocompressive step is used to bond substrates, and lacks the hydrofluoric acid bath disclosed by Bhat (See Bhat, col. 5, lns. 53-67). There is no motivation, suggestion, or other reason to combine the method of Cohn with the method disclosed in Bhat, which requires first bringing silicon substrates together in hydrofluoric acid, creating a weak bond between the substrates (See Bhat, col. 5, lns. 57-66), and then annealing the weakly bonded substrates while uniaxial pressure is applied via a weight (See col. 10, lns. 5-7). Bhat assumes that physical pressing is necessary to strengthen bonding, and Cohn does not teach any modification of Bhat's process. Accordingly, withdrawal of the rejection of claims 1 and 19, and their respective dependent claims is respectfully requested.

With respect to claim 4, the examiner states that Bhat discloses a process to improve bonding, which implicitly means to strengthen bonding. Bhat is directed to a

method of fusing dissimilar semiconductors. However, Bhat does not appear to disclose creating a temperature ramp and a pressure ramp, as recited in claim 4. Bhat teaches that a 200g weight is placed on top of the wafers to be bonded to assure close contact between the wafers, and that the temperature is raised to 650° C (See col. 3, lns. 44-50). That is, at least the pressure created by the weight used in Bhat remains constant once the weight is placed on the wafers. Moreover, Bhat fails to disclose a temperature ramp used to control the increase in the temperature of the wafers. Instead, Bhat simply teaches that the temperature is raised to 650°C. Accordingly, there is no teaching of creation of a pressure ramp or a temperature ramp in Bhat. For these additional reasons, applicants again request withdrawal of the rejection of claim 4.

Regarding claim 6, the examiner asserts that the abstract of Bhat discloses that the step of heating commences prior to the step of applying pressure. Bhat teaches, in the Abstract, that "while the wafers are forced together under moderate pressure...the temperature is raised to 650° C." That is, Bhat discloses that the temperature is increased while pressure is applied, and not before pressure is applied, as required by claim 6. For this additional reason, applicants again request withdrawal of the rejection of claim 6.

Additionally, regarding claim 17, the examiner asserts that the abstract of Bhat discloses that steps of applying, heating, and controlling and maintaining are carried out with a plurality of weakly bonded pairs of wafers simultaneously. However, this is not the case. While Bhat does refer to plural wafers, the reference is silent regarding plural pairs of wafers. Moreover, Bhat discloses that if one of the wafers is silicon, the

pair of wafers is assembled in hydrofluoric acid, and then the assembly is placed in a furnace for annealing (See Bhat, Abstract). Applicants note that Bhat references only a single assembly. For this reason, applicants again request withdrawal of the rejection of claim 17.

Regarding claim 20, applicants additionally traverse this rejection because the cited references fail to disclose or suggest inducing strain in a semiconductor wafer as part of the bonding process. The examiner asserts that strain is an inherent product of the heat and pressure used in the bonding process. Applicants disagree. Neither Bhat nor Cohn discloses subjecting the substrates to be bonded to any specific strain. Instead, the references merely teach that compressive force is used to bond substrates. In contrast, the present specification teaches that strains in the bonded wafers can be tailored by changing a level of pressure (See applicants' Specification, p. 6, lns. 26-27). Because the references are silent regarding inducing a strain in one or more of the substrates, as recited in claim 20, applicants again request withdrawal of the rejection of claim 20.

For all of the foregoing reasons, applicants submit that this Application is in condition for allowance, which is respectfully requested. The Examiner is invited to contact the undersigned attorney if an interview would expedite prosecution.

Respectfully submitted,

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January 28, 2009
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